EXAMINATIONS ON GERMINATION- AND GROWTH-INHIBITING EFFECT OF SOME SEED-EXTRACTS

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(Received 14, April, 1957)

Introduction

It is well-known that the seeds of some plant species may excrete inhibitors of different nature and effect into their environment (2, 4—11, 13, 15, 17). The data appear to be interesting among others from plant coenological point of view. In the present study the effect of seed-extracts of twenty cultivated plant species has been observed regarding germination of the seeds of a commonly known weed as well as the root-growth of their seedlings.

Materials and methods

The seed-extracts of the following species have been investigated:

Allium cepa L. »Makói«, Avena sativa L. »F«, Beta vulgaris L. »Beta Y 19«, Cannabis sativa L. »Bolognai«, Datura stramonium L., Foeniculum vulgare Mill., Helianthus annuus L. »Lovászpatonai«, Hordeum distichon L. »Hatvani 308«, Kniphofia uvaria (L.) Hook., Papaver somniferum L. »Fertődi kék«, Petroselinum hortense Hoffm., Phaseolus vulgaris L. »Bábolnai fehér«, Pisum sativum L. »Saxa«, Raphanus sativus L., Spinacia oleracea L. »Viktoria«, Secale cereale L. »Nyiri«, Trifolium pratense L., Triticum aestivum L. »Bánkuti 1201«, Vicia villosa Roth., Zea mays L. »Red King«.

As test the seeds of *Amaranthus albus* L. were used. The extraction with distilled water tested for 12 hours. The seeds were kept for the first 5 minutes of the 12 hours in 50 C° water while for the rest of the time in 5 C°. In the work is reported the effect of the extracts of 20 g. seeds/100 ml water as the most marked. The water extracts were centrifugated, 10 ml. of the purified liquid were taken and pasteurized for 15 minutes at 60 C°, then mixted with 10 ml. 3% agar and at last put in Petri dishes.[1] Under steril conditions the

[1] I am aware that the heat-sterilisation of the extracts destroyed not all the microorganism. On the other hand higher heat or repeated partial disinfection affect injuriously on the thermolabile or volatile compounds, consequently could not be applied. Anyhow partial disinfection proved. Indispencable as the microorganisms washed off from the seeds during extraction could influence the reliability of the results without it.

disinfected seeds of *Amaranthus* for germination had been placed on hardened agar surface employing MOEWUS (14) modified method suggested by BENTLEY and BICKLE (1). The dishes were placed in dark thermostat at 25 C°. The rate of germination has been hourly checked, the size of the roots — where for the sake of the uniformity the growth of the roots only the seeds germinated between 11—12 hours were taken into consideration — was measured 10 hours following the beginning of the germination. The standard error of the germination was ± 4%, and that of the root-growth maximally ± 6%.

Results and discussion

The figure shows that apart from exceptions smaller or larger germination inhibition appears in the case of most of the seed-extracts. The same holds good for the roots with difference that they more readly respond to the inhibitors than the seeds.

The stronges inhibitory effect could be noted in the extract of the species *Beta, Foeniculum* and *Petroselinum.* Effect of the *Beta*-extract has been studied by several investigators (4, 10, 11, 13, 16, 17). In the present examination 77% germination inhibition and 85% root growth inhibition could be observed with the concentration mentioned above. The specific character of the extract of the *Foeniculum* seeds is also known (15). It may be assumed that the considerable inhibition is produced by the volatile compounds of the seeds of the

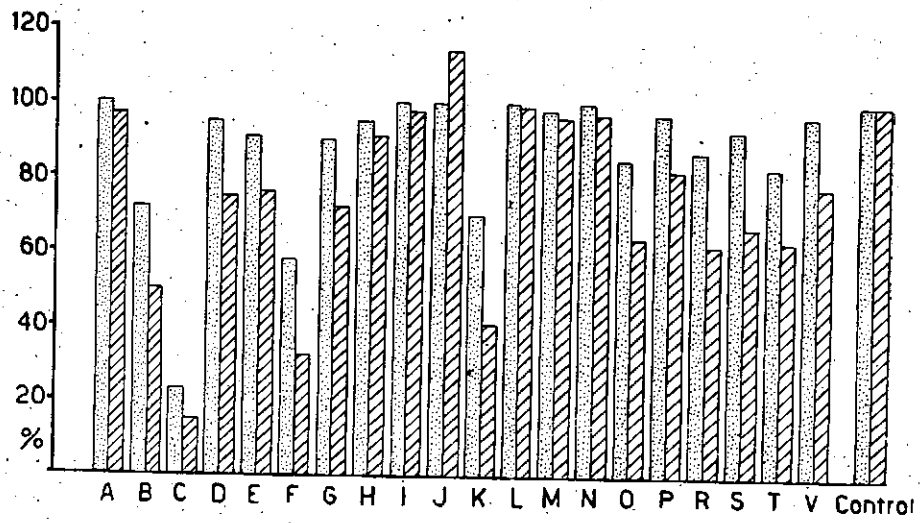

Fig. 1: Germination and root elongation of *Amaranthus albus* on water extracts of the seeds of different crops. Dotted colums: Germination of *Amaranthus* seeds as % of control. Lined columns: Size of roots of *Amaranthus* seedlings as % of control.

Extracts: A: *Allium cepa,* B: *Avena sativa,* C: *Beta vulgaris,* D: *Cannabis sativa,* E: *Datura stramonium,* F: *Foeniculum vulgare,* G: *Helianthus annuus,* H: *Hordeum distichon,* I: *Kniphofia uvaria,* J: *Papaver somniferum,* K: *Petroselinum hortense,* L: *Phaseolus vulgaris,* M: *Pisum sativum,* N: *Raphanus sativus,* O: *Spinacia oleracea,* P: *Secale cereale,* R: *Trifolium pratense,* S: *Triticum aestivum,* T: *Vicia villosa,* V: *Zea mays.*

three species mentioned above. Each of the three extracts produces a germination inhibition of more than 30% and more than 50% of root growth inhibition. Positive but significantly less germination- and growth inhibition appears in the seed extracts of several other species (*Avena* (5), *Datura, Helianthus, Spinacia, Trifolium, Triticum, Vicia-* and *Zea*). E. g. in the extract of *Avena* a 28% retention and 50% respectively can be observed. Still less inhibition is the extract of the seeds of a few other species.

The extract of the *Allium, Kniphofia, Phaseolus, Pisum, Raphanus* has no inhibition or it lies within the standard error. The extract of the *Papaver* seeds stimulates the root growth.

The seeds of the *Raphanus* contain a more vigorous inhibitor, called raphanin (12). In our investigation the extract of the seeds of the *Raphanus*, however, proved inefficacious. The reason for this is that the raphanin is liberated only by smashing of the seeds, due to a ferment effect; it can not be excreted from seeds germinating under natural circumstances.

An essential datum of the present examinations in one negative result: the extract of the seeds of the *Kniphofia* does not inhibit the sensitive tests employed here. At the same time the seeds of the *Kniphofia* contain an antibiotic of considerable effect (7—9). The extract used here showed also a significant antibacterial activity. Should the crops show such behaviour toward the *Kniphofia* antibiotic as did the weeds examined, so we may hope to produce a new chemotherapeutic agent.

Questionable is, however, how far come into full display the inhibitory effects described above in the soil. A significant part of the inhibitors are very likely absorbed by the soil (3). Nevertheless it may be assumed that their effect next to the seeds may play a role. It is probable that the crop may influence the other plants already at the earliest period of its development.

Summary

Effect of seed-extracts of twenty crops has been observed for germination of seeds as well as for the root-growth of the weed *Amaranthus albus* L. The water extracts of the seed of *Beta, Foeniculum* and *Petroselinum* exerted a fairly strong inhibition, while those of eleven other species relatively did less. The root-growth test proved to be more sensitive than that of the germination. No effect had the extract of *Allium, Kniphofia, Phaseolus, Pisum* and *Raphanus*. On he other hand, the extract of *Papaver* seed stimulated the growth of the roots. The antibiotic of *Kniphofia* seeds, not having inhibited the sensitive tests with *Amaranthus* seems to be chemoterapeutic agent.

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